Appendix F
SOW 6643-A-0398

Trainer Description for Device 2F193A C TOFT,
Serial Number 016 at
MCAS Iwakuni, Japan

1.0 **TRAINER DESCRIPTION**

1.1 Function and General Description:

a. The "C" TOFT was built by L3 COMMUNICATIONS, Training Systems Inc., Arlington, Texas. The TOFT is designed to include the basic pilot with advanced pilot training in weapon systems pertaining to the FA-18 aircraft.

The TOFT is used for training FA-18 pilots in the following areas:

- Full aircraft ground and airborne systems operations
- Limited Air Combat Maneuvering (ACM)
- Air-to-Air Weapons Delivery
- Radar Imagery
- Radar Warning System Operation
- Carrier Approach and Landings
- Normal/Emergency procedures
- Air-to-Ground (A/G) Weapons Delivery with associated Sensor Video
- Targeting FLIR
- Joint Helmet Mounted Cueing System (JHMCS)
- Single aircraft federation
- Multi-aircraft integrated/federation for team, inter-team, JTFT and BFTT.

TOFT Serial Number 16 is configured to simulate the FA-18 C/D aircraft and consist of only the pilots training station and can be linked together to provide crew training.

b. The TOFT consists of seven functional systems: training station, visual system, instructor/operator station (IOS), digital computer complex with peripherals, Input/Output (I/O), Communication and a power distribution system.

The TOFT realistically simulate the flight characteristics of the FA-18C aircraft and systems including visual, terrain, airfield, ocean surface, atmospheric phenomena, surface and air target images, missile trails as viewed from the cockpit and aural cues associated with each. Supporting the virtual simulators is a Mission Operations Center (MOC) room and two Brief/Debrief Stations (BDS). Visual cues are the result of computer-generated imagery (CGI) and are projected onto the exterior of a nine-facet SimuSphere™ screen system centered at the design eye. Visual cues include background sky and terrain and target images. Target images can be used to display friendly and adversary air and ground targets. Aural cues are the result of computer-generated digital cues. Aural cues include tactical tones and environmental sounds that a pilot normally hears in the cockpit. Each virtual simulator provides the capability to conduct training sessions in which the trainee opposes multiple adversaries. Each virtual simulator may operate in a single-aircraft federation or a multi-aircraft integration/federation in realistic operational and threat environments in

support of team, inter-team, Joint Task Force Training (JTFT) and Battle Force Tactical Training (BFTT). Instructional features include operator/instructor intervention during a session (changing environmental conditions and inserting malfunctions), operator/instructor or computer control of the adversary aircraft, and hard copy reproductions of any MOC or IOS display consisting of either a Cathode-ray tube (CRT) or liquid crystal (LCD) displays. Each virtual simulator (VS) is made up of a SimuSphere™ and Cockpit, PC-Host computer, PC Image Generator (PCIG), power cabinet, NVTS cabinet, JHMCS Cabinet, Aircraft Interface cabinet (AIC) and IOS console.

c. The TOFT has the capability of long haul integration with other devices not within the trainer facility. The NASMP Gateways will connect, but not limited to the TOFTs at NAS Oceana and NAS Lemoore to the Navy Continuous Training Environment (NCTE) Network allowing devices to participate in training exercise with other training facilities and services.

d. The NASMP Gateway provides network simulation data bi-directionally between the TOFTs and other devices on the NCTE. The NASMP Gateway shall traffic data via the NCTE in accordance with the IEEE 1278-1A 1998 DIS standard. The Gateway will provide mechanisms for independently turning on and off the trafficking of data in either or both direction across the gateway during runtime.

The Gateway will occupy a single commercial cabinet within the trainer spaces to house all hardware to operate the system. The Portal Computer is a Dell PowerEdge 2850 rack mounted unit, Test computer Dell PowerEdge 1850, rack mounted. The cabinet also has Hard Drives, 12 port Cisco switch, and inter-connecting cabling

1.2 Trainee Station:

1.2.1 The TOFT trainee station is a reproduction of the operating environment of the actual aircraft. The flight controls, multipurpose display and control group, and instrument panel pedestal are simulated aircraft components. The console assemblies are replicate of the aircraft's except that the construction is modified to fulfill the trainer needs.

1.2.2 The trainee station consists of two basis subsystem elements: (1) cockpit and (2) Visual system.

1.2.3 The trainee station cockpits encompasses the following subsystems:

a. Power-plant Systems. The F404-GE-400/404 engines of the design basis aircraft are simulated together with the related controls, control and instruments. Static and dynamic engine performance is simulated along with the associated instrument indications, fuel consumption, and sound.

b. Fuel System. The fuel system of the design basis aircraft is simulated for quantity indication, fuel available logic, weight, and center of gravity. Instructor controls are provided to vary the total fuel

quantity, including drop tanks, with the range of its capacity. The instructor may freeze the fuel system, at any point during the mission.

c. Secondary Power System. The functions of the secondary power system of the design basis aircraft are simulated together with the related control, indications, and displays.

d. Electrical Power Supply System. The electrical system is simulated to the extent of cockpit indications and control and bus logic for the left and right generators, utility and emergency batteries and external ground power.

e. Hydraulic Power Supply System. The hydraulic system (HYD 1 and HYD 2) of the design basis aircraft is simulated for system control distribution logic. The normal hydraulic pressure is provided except for malfunctions.

f. Flight Control System. The flight controls of the design basis aircraft are simulated for feel and aerodynamic response.

g. Automatic Flight Control System (AFCS). Dynamic simulation of the AFCS is provided.

h. Landing Systems. Simulation of the landing gear, nose-wheel steering, brakes, launch bar, and arresting hook is provided.

i. Wing Fold System. Simulation of the wing fold system is limited to feel and cockpit indications only.

j. Instruments, Indicators, and Displays. Simulation of the following equipment is provided:

(1) Heads Up Display (HUD)
(2) Left Multi-Purpose Indicator (MDI)
(3) Right Multi-Purpose Indicator (MDI)
(4) Multi-Purpose Color Display (MPCD)
(5) Up Front Control (UFC)
(6) Angle of Attack (A0A) Indexer
(7) Attitude Reference Indicator (ARI)
(8) Standby Airspeed Indicator
(9) Standby Rate-of-Climb Indicator
(l0) Standby Magnetic Compass
(11) Radar Altimeter
(l2) Cockpit Altimeter

k. Fire Detection/Extinguishing Systems. The fire detection/extinguishing system are simulated to the extent of cockpit indication and engine performance.

l. Entrance/Egress System. The egress is comprised of a pneumatic ram that opens facet #7 for cockpit access

m. Ejection Seat. Replica of aircraft seat--Non-functional

n. Environmental Control System. Non-Functional

o. Oxygen System. Non-Functional

p. Air Data Computer: Simulated including all required inputs.

q. Communications-Navigation-Identification Equipment

r. JHMCS: Simulated including all required inputs.

(1) Intercom System. Simulation of the intercom systems permits communications between the pilot and the instructor with the instructor corresponding to a ground or ship based control agency. Control and signal processing of audio tones, which are simulated, provide for all systems in the same manner as in the design basis aircraft.

(2) UHF Communications System (AN/ARC-182). The two receiver-transmitters (COMM1 and COMM 2) are simulated for both communications and automatic direction finder (ADF) functions. The system provides appropriated communication links between the IOS and the Trainee Station.

(3) Tactical Air Navigation (TACAN) System (AN/ARN-118). The TACAN system is simulated for relative bearing and slant range distance indication to a ground station. Station identification tones are simulated.

(4) Inertial Navigation System (AN/ASN-130). The inertial navigation system is simulated, including inertial platform orientation, signal data converter, controls and indicators, and all alignments.

(5) Backup Attitude and Navigation System. Backup attitude and navigation system is simulated.

(6) Identification System. The IFF set is simulated.

r. Mission Computer System. The TOFT uses a software emulation to replace the aircraft's mission computers. The emulator performs most of the same functions as the Mission Computers. MC1 performs processing for the aircraft built-in test (BIT), aircraft operation status monitoring, and provides backup for MC2, the tactical computer. MC2 performs processing and control/display management for air-to-air combat, air-to-ground attack, navigation, and backup for MC1.

s. Stores Jettison System. The stores jettison system is simulated to provide jettison of external stores and racks as in the aircraft.

t. Weapons Systems. Aircraft air-to-air and air-to-ground weapons are simulated including all conventional and special weapons compatible with the design basis aircraft.

1.3 Instructor Station: The instructor station is integral with the control station.

1.3.1 Control Station. The virtual simulator's operating system is controlled from the IOS console. The console provides the capability for mission formulating, control, and monitoring through the use of a windows operating environment. The Instructor/Operator Station (IOS) provides the instructor/operator with controls to initiate, develop, change, freeze and monitor training scenario. Two monitors display IOS pages to support the selection and control of the training scenario. Two additional monitors can be used for cockpit repeaters for the HUD and MDI's. Additional display can be used for the interactive functions. The instructor can "FLY" and aircraft using a control stick and throttle. Additionally, the operator/maintenance can check the trainer systems operation via the Daily Readiness Equipment Diagnostic (DRED).

1.3.2 IOS Cabinet: The IOS cabinet contains the electronics units to support the IOS console controls and displays. Inputs and outputs are routed through the time base corrector and/or video distribution amplifiers to improve signal clarity and through the video switch to provide additional display and printing capabilities for the user.

1.3.3 Principal components are:

a. Console with a work surface

b. Visual Monitors (CRT) for Trainee Station displays selectable functions to allow for various monitoring criteria.

c. Input Devices, e.g. keyboards, mouse, LSO handgrip, and Throttle control Stick, Flight control stick, etc.

d. Communication equipment, e.g. headset and control, speakers, microphone and volume controls.

1.4 **Computer System, Peripherals, and Interface Cabinets:**

1.4.1 The PC host computer provides initialization, mode/state processing, initial conditions selection, and synchronization. The PC host computer also provides simulation of aircraft and environment parameters. It provides the necessary timing and control of all other processors in the group during real-time operation. The host computer is a commercially available rack mounted PC System complex. The PC host consists of a master PC and five slave PCs. User control when needed is accomplished by an in rack mounted Controller. The controller consists of a 15-inch LCD display, keyboard, trackball mouse and 8-port keyboard video mouse switch. A 24-port 10/100/1000 Ethernet switch interfaces the PC host to the device.

1.5 **Aircraft Common Subsystems**: N/A

1.6 **Power System**:

1.6.1 The trainer power distribution system controls and distributes the ac and dc power required to operate the trainer. The system is furnished with 120/208 VAC, 3-phase, 60 Hz power. Various dc voltages are required in some equipment.

1.6.2 The AC power is controlled by Power Management Module (PMM). The PMM receives the 120/208 VAC, 3-phase, 60Hz power from the facility supply. The power cabinet is designed to distribute a maximum of 300 KVA input. The phase sequence of the input power is Phase A,B,C. The power cabinet has a DMMS 300+ Solid State Digital Triple Display Multi-Function Power Monitoring System (DMMS) installed for monitoring power fluctuations. The DMMS can display the current, voltage and power consumption for the total system as well as each phase or between phases.

1.6.3 The DC power required to operate the trainer is furnished through dc power supplies located in the AIC and IOS cabinets. The various power supplies generate +5,+/-10,+/-15,+24 and +28Vdc.

1.7 **Visual System: Semisphere™ Visual System**

1.7.1 TOFT trainer 16 consist of seven (7) rear projection visual projectors type Electrohome 9500LC projectors. The visual system displays the out-the-window (OTW) visual scenes to support the student training. Scenes are generated via modeled databases stored in the IG combined with simulated on-ground and in-flight inputs from the student pilot interfacing with cockpit controls. The field of view (FOV) for each of the OTW channels is software controllable to match the applicable projection system. The Visual System includes visual and radar databases, SimuView™ Image Generator (IG), Head Tracker, virtual head up display (HUD), eleven rear projection display channels, and cabling. The OTW scenes are provided by the visual system, which uses eleven rear projection systems to display the images. The rear projection systems consist of the following: one facet each on the left and right forward, left and right aft, left and right upper forward, upper aft and directly aft which include projector, screen, mirror, and framework; one center system forward of the cockpit which includes projector, pedestal, screen, and one virtual head up display system including a projector and pedestal, which projects the head up display (HUD) on the center facet. A head tracker system provides head motion compensation for the overall visual scene.

1.7.2 SimuView™ Image Generator (IG). The SimuView IG consists of four (4) cabinets containing a group of personal computers networked together and the required supporting hardware to provide high speed real-time graphics scenes for training. The aft IG consists of three OTW cabinets identical to the forward IG with the exception of the IFLOLS PC, which is not installed. The major items contained in the SimuView IG are:

1. Cabinet 1 containing Pager node #1, Master control processor (MPC) #1 node, ISECT node #1, Channel 1 video combiner, Channel 2 video combiner, Channel 3 video combiner, Channel 3 render nodes 1-4, Channel 2 render nodes 1-4, Channel 1 render nodes 1-4, Video amplifier chassis, 24-port gigabit switch, and 16-port gigabit switch
2. Cabinet 2 containing IFLOLS node, Channel 4 video combiner, Channel 5 video combiner, Channel 6 video combiner, Channel 6 render nodes 1-4, Channel 5 render nodes 1-4, Channel 4 render nodes 1-4, 24-port gigabit switch, and Video amplifier chassis

3. Cabinet 3 containing Channel 7 video combiner, Channel 8 video combiner, Channel 9 video combiner, Channel 9 render nodes 1-4, Channel 8 render nodes 1-4, Channel 7 render nodes 1-4, and 24-port gigabit switch
4. Cabinet 4 Pager node #3, MPC #3 Node, ISECT node 3, HUD Node, IOS #1 node, AUX node, Pager node #2, MCP #2 node, ISECT node #2, AGL node, Sensor node #1, Sensor node #2, 24-port gigabit switch (LAN#2), 24-port gigabit switch (LAN#2), and Amplifier chassis (AMP#1-3).

1.7.3 Head Tracker. The visual system provides a function referred to as "Virtual Vignette" which provides head motion compensation so that the overall visual scene perspective due to head motion is correct for both close and distant scene elements. The head tracker transmits and receives information to/from the IG. This information is then transmitted from the PCIG to the host computer. Using the information received from pilot head position, the host computer performs calculations that shift the eye-point position data to the PCIG as a function of the pilot's head position. The effect provides an element of realism that duplicates looking out of an aircraft as opposed to viewing an image on a screen positioned 40 inches from the viewer's eye-point.

1.7.4 Visual Mirror Assembly. The assembly consists of five (5) flat glass and three (3) Mylar mirror assemblies, one on every facet except the center forward facet, are used to reflect the images to the applicable screen. The three mylar mirrors are attached to the top of the visual display. Each mirror is coated with a reflective film.

1.8 Motion System: N/A

1.9 Air Conditioning System: The FA-18 C-TOFT incorporates its own air conditioning system.

1.10 Motor Generator Sets: N/A

1.11 Hydraulic System: N/A

1.12 Pneumatic System: The ingress/egress is comprised of a pneumatic ram that opens facet #7 for cockpit access. This ram receives its source from a small pancake air compressor located under the computer flooring.

1.14 On-Board Oxygen Generating System (OBOGS): Hypoxia Training is provided at NAS Oceana, NAS Lemoore and MCAS Beaufort in conjunction with medical personnel. Contractor shall provide the required oxygen and nitrogen bottles necessary to perform hypoxia training. Contractor shall be responsible for refilling bottles on an as needed basis (approx. every 3 months for Oceana and Lemoore; one per month for Beaufort). Contractor may be required to assist medical personnel in set-up of hypoxia training scenario.

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2.0 **Illustrations:**
Complete lists of illustrations are available at each training device location.

3.0 **Mission Essential Subsystem Matrix:** Not Applicable

4.0 **CONTRACTED TRAINING TIME**

Training Operations shall be provided in each FY as per exercised contract CLIN/SLIN per device from one of the stair steps below:

2F193A-16 F/A-18 TOFT **Contracted Training Time (CTT) Monday thru Friday (M-F)** **MCAS Iwakuni, Japan**		
Hours per Week (HPW)	**Start Time (local) (Notional)**	**End Time (local) (Notional)**
15	0900	1200
25	0800	1300
40	0800	1600
Remark(s) / Note(s)		
1-CTT time represents continuous hours of device operational training availability from initial START time. 2-CTT does not include weekend (Saturdays/Sundays) training, and no weekend training planned. 3-CTT daily Start Times are notional and may vary/shift with coordination and direction from the Contracting Officer's Representative (COR)/site scheduling authority and may change during the course of the Task Order. (Refer to Addendum A, paragraph 4.3.1). 4-CTT may be shifted between devices with coordination and direction from the Contracting Officer's Representative (COR) and Contractor Site Manager. 5- Historically the trainer is utilized no more than 8 hours in a training day; however the Government reserves the right to transfer training hours to device 2F201-37 as long as total does not exceed combined CTTs		
Table 4.1		

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5.1 Aircraft Common Equipment (ACE)

Complete list of ACE can be found in the inventory list provided at each site.

The Material Support Package (MSP) inventory of this solicitation will be determined by the results of CDRL A005 “COMS/CMS CONTRACTOR INVENTORY/UTILIZATION REPORT OF GFP/GFI”. The results of the transition inventory will be verified and signed by the site COR prior to Contractor’s submission of CDRL A002 to the Government.

NOTE: Whenever minor configuration changes, calibration or adjustment of aircraft common equipment is required for use in the trainer, such information shall be provided in this Appendix.

5.2 Trainer Equipment. Depot level (D-level) maintenance for the following trainer equipment is the responsibility of the government.

Complete list of D-level trainer equipment will be provided at each site.

5.2.1 Trainer Support Package (TSP): Includes Tools/Support Equipment, Spare Parts, Technical Data Support Package, and Software Support Material. The formal inventory (i.e. tools/support equipment, spare parts, technical data support package, and software support material, etc.) shall be those items identified during the mobilization period and stated in the yearly Inventory/Utilization Data Report. The Contractor shall comply with the development, maintenance and submission requirements for this report, as stated in the applicable CDRL item."

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6.0 **PARTIAL MISSION CAPABILITY STANDARD** Partial Mission Capability (PMC) is a condition in which degraded operation (less than 100% operationally Ready) still permits meaningful training or alternative training to be accomplished. The percentage of degradation is relative to the Essential Operational Capability (EOC) codes, which are derived from the MESM. The relationship between missions and training device systems/subsystems, and EOC codes are represented in the MESM. The EOC code also relates to the percentage of deduction from the authorized payment for the affected period. See table below for PMCS deduction schedule.

EOC	% MISSION CAPABLE	% OF DEGRADATION
B	100	0
C	90-99	10
D	80-89	20
E	70-79	30
F	60-69	40
G	50-59	50
H	40-49	60
J	0-39	70

NOTE: Partial Mission Capability (PMC) is the material condition of a training device that cannot perform all of its missions.

PARTIAL MISSION CAPABLE LISTING
DEVICE 2F193A TACTICAL OPERATIONAL TRAINER (TOFT)

Failed Equipment	EOC Code	PMCF
A. Cockpit Displays		
UFCP	F	40%
LMDI	E	30%
RMDI	E	30%
MPCD	E	30%
ADU	C	10%
IFEI	D	20%
ALR-67	D	20%
B. Cockpit Instruments		
Standby Airspeed Indicator	C	10%
Radar Altimeter	F	40%
Vertical Velocity Indicator	D	20%
Barometric Altimeter	D	20%
Brake Accumulator Pressure Gauge	C	10%
Hyd 1 Hyd 2 Pressure Indicator	C	10%
Battery Indicator	C	10%
Standby Magnetic Compass	C	10%

C. Cockpit Panels		
Advisory and Threat Warning Ind Left	E	30%
Advisory and Threat Warning Ind Right	E	30%
Master Arm Panel	D	20%
Jettison Station Select	C	10%
Heading and Course Switch	C	10%
ECM	C	10%
Video Record	N/A	
Landing Gear	D	20%
Left Hand Vertical Console Control	N/A	
Emergency and Parking Brake	D	20%
Hook Handle	D	20%
Right Hand Vertical Console Control	N/A	
Caution Light Panel	D	20%
Wing Fold Handle	B	
Fire Test Panel	D	20%
Ground Power Panel	B	
Generator Tie Control Switch Panel	D	20%
Exterior Lights Panel	D	20%
Fuel Control Panel	C	10%
Auxiliary Power Unit, Engine Crank Panel	B	0%
Flight Control System Panel	D	20%
Communication Control Panel	D	20%
Antenna Select Panel	B	0%
Hydraulic Isolate Panel	C	10%
Electrical Power Panel	C	10%
Environmental Control Panel	B	0%
Defog Panel	B	0%
Interior Lights Panel	D	20%
Sensor Control Panel	D	20%
Fan Test Panel	D	20%
ECM Dispenser Button Panel	C	10%
Left Hand Circuit Breaker Panel	C	10%
Right Hand Circuit Breaker Panel	C	10%
Knee Board Chart Light	C	10%
Lock/Shoot Indicator	C	10%
Trainer Control Panel	N/A	
ARL-67 Control Panel	D	20%
D. Flight Controls		
Stick Assembly	H	60%
Rudder Assembly	G	50%
Toe Brakes	D	20%
Throttle Quadrant	Z	100%

Ejection Seat	N/A	
C. INSTRUCTOR/OPERATOR STATION		
HUD/OTW Repeater	D	20%
Cockpit Repeater - (IAD-4)	D	20%
Interactive Display - (IAD 1,2,3)	D	20%
Data Entry - (Mouse)	D	20%
Data Entry System - (Keyboard)	D	20%
Instructors A/C Controls - (Stick/Throttle)	C	10%
Audio System - (Headsets/Mics/Speakers)	G	50%
Superview 500 Windowing System	D	20%
D. VISUAL SYSTEM		
Head Tracker	E	30%
JHMCS	E	30%
NVG System	E	30%
PROJECTOR 000- Center OTW	G	50%
PROJECTOR 001 - IFLOLS	E	30%
PROJECTOR 002 - Forward Right OTW	E	30%
PROJECTOR 003 - Forward Left OTW	E	30%
PROJECTOR 004 - Forward Upper Right OTW	E	30%
PROJECTOR 005 - Forward Upper Left OTW	E	30%
PROJECTOR 006 - Aft Right OTW	E	30%
PROJECTOR 007 - Aft Upper Left OTW	E	30%
PROJECTOR 008 - Aft Upper Center OTW	E	30%
PROJECTOR 009 - Aft Center	E	30%
PROJECTOR 010 - Virtual HUD	Z	100%
20" DISPLAY REPEATER - MOC	C	10%
20" DISPLAY REPEATER - B/DS	C	10%
50" DISPLAY REPEATER - MOC & B/DS	C	10%
E. AIRCRAFT SYSTEMS INTERFACE CABINET (AIC)		
Crown Audio Amplifier	Z	100%
VME I/O Chassis	Z	100%
F. COMPUTER/PERIPHERALS		
Host Computer	Z	100%
Image Generator PCIG	Z	100%
Instructor/Operator Systems Cabinet	Z	100%
Mission Computer Emulator (MCE)	Z	100%
IOS Printer Unit (Laser Printer))	C	10%
File Server	Z	100%
Digital Audio Communication System	Z	100%

Simi-Stealth	Z	100%
Logger - IOS	Z	100%
Router	Z	100%
Time Server	Z	100%
Reflective Memory	Z	100%
Gigabit Switch	Z	100%
Telestra (Envir Sound)	Z	100%
G. MOC/BDS		
Printer Unit (Laser Printer))	C	10%
Interactive Display - (IAD 1,2)	C	10%
Data Entry System - Mouse	C	10%
Data Entry System - Keyboard	C	10%
Audio System - (Headsets/Mics/Speakers)	C	10%
Simi-Stealth	C	10%
Joy Stick	C	10%
20" Display Repeater - MOC/BDS	C	10%
50" Display Repeater - MOC & B/DS	C	10%
RTI	C	10%
File Server	C	10%
Encoders	C	10%
Decoders	C	10%
H. POWER DISTRIBUTION SYSTEM		
Main Power Distribution	Z	100%
I. MECHANICAL		
Air Compressor	E	30%
Cylinder, Air	E	30%
Flow Control Valve	E	30%
Pneumatic Control Assy	E	30%
J. INTEGRATED MODE OF OPERATION		
Loss of one cockpit - integrated mission	E	30%
Loss of more than one cockpit - integrated mission	G	50%
Loss of sectional training	Z	100%

7.0 **FLOOR PLANS AND PROJECTED ADDITIONS.** A complete list of floor plans and projected additions are available at each training device location.

8.0 **JANITORIAL REQUIREMENTS.** See Appendix AA.